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ABSTRACT

This report discusses four different types of instruction which enable learning disabled or low achieving students to learn well enough to transfer the skill to a novel situation. After asserting that generalization depends on systematic instruction, the paper describes the four procedures: (1) teacher-directed generalization; (2) direct instruction for generalization, in which training for generalization is incorporated into instruction; (3) reciprocal teaching, in which preparation for generalization occurs throughout the instruction; and (4) a directed but discovery-oriented approach, in which students are helped to look for patterns and regularities in their learning. Critical aspects of instruction for generalization are identified, including student understanding of the goal of the task and sufficient opportunity for practice. A study demonstrating the effectiveness of invariance training, in which students were taught that written symbols and sounds corresponded, and were urged to search for regular relations between letters and sounds, is cited. (CL)

Instruction that Affords Skill Transfer

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As teachers, there are a number of criteria we can set to evaluate whether a student has learned a skill we've taught. We can ask whether the student can use the skill with teacher assistance and prompting. A second criterion is whether the student can use the skill independently. We can also measure whether the student continues to use the skill over time. And finally, on certain occasions we want to know whether the student is able to use the skill in a novel situation. Cognitive psychologists refer to this final criterion for learning, use of the skill in a novel situation, as generalization or transfer.

Psychologists and teachers agree that of all the criteria for evaluating learning, generalization is the most difficult one to meet. They agree that when students do generalize what they've learned, the student has "really learned" what they've been taught. When students fail to generalize, there is less agreement about what this means. Some argue that students haven't truely learned a skill until they generalize its use. Others suggest that learning occurs first, and that learning to transfer may occur afterwards, or it may not occur at all.

My purpose today is not to debate distinctions between learning and transfer. Rather, I plan to describe 4 different types of instruction which enable students to learn well enough that they meet the criterion of transfer. Each type of instruction I describe, except for the last type, has been used successfully with learning disabled or low achieving students. However, each type of instruction I will describe is complex. I

don't mean to suggest that teachers should provide such elaborate instruction for every skill that they teach. However, teachers can identify certain skills which have general utility for the student. In these instances, when the student could benefit from learning to use a skill well enough to transfer it, a teacher should plan for generalization in her instruction. In these instances, a teacher could consider one of the forms of instruction I will review today.

Before I begin to describe the instruction, I want to make a few comments about expectations for generalization among learning disabled students. The clinical literature paints a pessimistic picture, often suggesting that learning disabled students may have great difficulty in generalizing newly learned skills. We have limited data which test whether or not this is actually true. Those data which do exist seem to be consistent with Jeanne Day's conclusion that learning disabled students learn slowly, but they do transfer. There are a handful of studies which show that learning disabled students do transfer newly learned skills. It is important, though, that in every instance where learning disabled students have shown transfer, they have been given very systematic instruction. Thus, it seems that we can expect learning disabled students to generalize, but we must also expect their teachers to work hard before this occurs.

The first program for generalization I describe is an example of a teacher working hard. In fact, the teacher works so hard that I call this approach "Teacher-directed generalization."

This approach was developed at the Learning Disabilities Research Institute at the University of Kansas, as a part of their learning strategies curriculum (Schumaker, Deshler, Alley, & Warner, 1983). With this curriculum, high school age learning disabled students demonstrated that they had learned the strategies, but then they didn't transfer the strategies. Taking the approach that generalization is something that occurs after learning, the instructors added an instructional step which occurs after students demonstrate mastery of a strategy.

First, the teacher obtains a commitment from the student that the student will generalize. To orient the student, the teacher tells the student the occasions when they should use the strategy. They discuss how to adapt the strategy for these occasions. The teacher tells the student the cues to use to decide whether or not to use the strategy. To activate the student, the teacher programs for the student the use of the strategy across a range of tasks, and provides feedback about how well the student is generalizing. Not surprisingly, most learning disabled students generalize with this approach.

Clearly, in this approach the teacher is the one who understands that the skill has general utility. The student's job is to do as the teacher tells him, and to use the strategy whenever he is directed to do so. Hopefully, through the experience of using the strategy in a variety of situations, and receiving feedback about the effectiveness of doing so, the student begins to understand what the teacher understands. That

is, the student may learn that the strategy has general utility, and also learn the characteristics of the situations when the strategy should be used.

At the Learning Disabilities Research Institute at Teachers College at Columbia University, we developed a different model of instruction to enhance skill transfer (Gelzheiser, Shepherd, & Wozniak, in press). Because we relied heavily on the techniques of direct instruction, I'll refer to this approach as direct instruction for generalization.

Rather than adding the instructional step of teaching for transfer after a student had learned a skill, we incorporated the training for generalization into the instruction. As a matter of fact, we began by teaching students what we thought they would need to know in order to generalize. In a first lesson, we taught a concept of appropriate skill application. We told students that they were going to learn a strategy which was useful with certain kinds of materials. In order to know whether or not to use the strategy, they would have to be able to pick out the materials where the strategy would be useful. We taught them the characteristics of the class of materials where they should use the strategy. Using this concept, they practiced discriminating the target materials from other materials.

When we were confident that students could pick out the target materials, we then taught them the strategy. We told students that the strategy would always be helpful with certain materials, and provided enough practice in using the strategy that

we were confident that students had mastered it. Early on, we used easy materials, and introduced more difficult materials as students became more proficient. We hoped that by keeping demands at a minimum, students would be able to pay attention to the fact that the strategy was helping them. To encourage students to see that the strategy was a useful one, we provided feedback to students, showing them that their performance was improving. Students graphed their progress. We also used an incentive system, to encourage students to maintain interest during all of this practice.

We used this approach to teach junior high school age learning disabled students to use several organizing strategies while memorizing. Students learned to group together similar items during study, to name each group they had made, and to recall items according to the groups they had formed. A majority of our instructed learning disabled subjects did transfer all of these strategies. While they had learned to use the strategies to memorize lists of objects, they transferred them and used them to memorize facts from a passage.

A third approach to encouraging learning disabled students to transfer has been termed reciprocal teaching (Palincsar & Brown, 1984). Developed at the University of Illinois, it incorporates almost exactly the same instructional techniques as we used in our direct instruction for generalization approach. However, it differs from our work at Teachers College in several significant ways. First, in reciprocal teaching, the preparation for

generalization occurs throughout the instruction, rather than at the beginning as we had done, or at the end, as done at the University of Kansas. Throughout their program, Palinscar and Brown reminded students that the strategies were generally useful ones, and that they should endeavor to use them independently, whenever they read. Another difference, I think, is that Palincsar and Brown had a different problem to solve to get generalization. They didn't need to teach students to identify the class of tasks where the strategies would be useful, as we did. Clearly, their students could identify text; what Palincsar and Brown had to do was to persuade students to use the strategies whenever they encountered text.

A final difference between the two programs is the use of reciprocal teaching with small groups of students. This technique was designed to insure mastery, and to insure that students were attending to how the strategies helped them get to the goal of adequate comprehension. In reciprocal teaching, difficult materials are used right from the start, but the teacher provides a great deal of support and direction for students. The teacher is constantly available to show students the benefits of strategy use, to model expert performance, and to provide feedback and correction. With practice and proficiency, teacher support is faded, and students gradually play the role of the teacher! Students monitor and evaluate their own strategy use and that of peers in the group.

Using reciprocal teaching, Palincsar and Brown have

repeatedly obtained substantial evidence for generalization of reading comprehension strategies among junior high age poor readers. They have concluded, as we concluded at Teachers College, that several aspects of instruction are critical if generalization is to occur.

First, students must know where they are going -- they must understand the goal of the task. While this sounds obvious, researchers who have observed classrooms find that some teachers usually forget to tell their students the purpose of their work. For example, a teacher may forget to tell students that they are doing a worksheet to practice a phonics skill which they should employ whenever they read. The students then conclude that the purpose of the worksheet is to do a worksheet, and don't realize that the skill they are learning could be used in other places.

If the goal of instruction is general use of the skill on a range of tasks, students must be told this explicitly. Thus, a second factor which is critical to generalization is a concept of the class of tasks where the strategy can be applied. Sometimes this class of tasks is obvious, and students need only to be reminded of it. In other instances, the concept of appropriate application is not obvious, and must be taught directly.

We have also learned that attending to the goal of the task at the same time you are just learning a new skill is difficult. Since it is critical that students see the goal of the task at all times, at first the task must be made easy for students. This can be done, as we did, by using very simple materials at first, or it

can be done by providing additional teacher support, as is done with reciprocal teaching.

A fourth factor which is critical to generalization is to provide sufficient practice for proficiency. If students are to carry out the strategy independently and in a goal directed fashion, they must be proficient in the use of the strategy. Such proficiency requires practice, and lots of it. We taught relatively simple strategies for memorizing, and took 3 hours to do so. Palincsar and Brown took 16 hours to teach their comprehension strategies. I suspect that these skills would not have been learned well enough to be transferred if less time had been devoted to instruction.

A final factor that is important to generalization is insuring that students see the connection between the skill they are learning and the goal they are working to attain. Again, seeing this connection implies that the student is not bogged down in carrying out the strategy. To see the benefit of the strategy, the student must have the resources available to see whether or not the strategy is working. This is easy for the student to do when he has attained proficiency, after much practice. Before proficiency is attained, the teacher can use feedback, graphs, and rewards to remind students that the strategy helps to attain their goal.

I believe that we know a fair amount about the kind of instruction needed for generalization to occur. However, I don't believe that we have all the answers yet. Recently, I've become

interested in another promising approach to attaining skill generalization. Gibson and Levin (1975) suggest that students are more likely to transfer if they discover for themselves concepts, patterns, regularities, or invariance in a task. Gibson and Levin argue that we may do students a dis-service if we tell them particular rules or patterns, because students who are told a rule are not prepared to learn others independently. They suggest that the role of instruction is to teach students where to look for patterns and regularities, and to assist students in extracting these patterns themselves. By giving students a "set" to look for invariance, and directing them where invariance can be found, we teach students a general skill which they can use to learn a variety of concepts.

Gibson and Levin do not advocate a pure "discovery" method; instead, the teacher plays an active role in encouraging students to look for patterns, and directing them as to where those patterns can be found. At the same time, they do not advocate a direct instruction approach, where students are told exactly what they should be learning. Instead, they propose an option which combines features of both discovery and direct teaching methods.

Gibson and Levin's ideas are intriguing ones, and made a great deal of sense to me as a teacher. Since they present only limited data to support their ideas, I designed a study to test their view. Unfortunately, I have only pilot data to report today. Fortunately, the data do provide strong support for Gibson and Levin's argument.

The study that I designed addresses the question of the best way to teach letter/sound associations. I tried three methods of instruction with normally achieving third graders. The first was a whole word approach, analogous to a discovery method. Students were given no guidance about the particular sound/symbol correspondences they were asked to read. A second kind of instruction was direct phonics instruction; students were explicitly taught particular letter/sound associations. I compared these two approaches to a third method I called invariance training. In the invariance training, students were taught that written symbols and sound correspond, and that in learning the code in reading, they should look for regular relations between letters and sounds. They were given practice in searching for symbol/sound correspondences, and saw that they could extract these patterns successfully.

Students in the phonics condition were taught the correspondence between 4 written symbols and 4 syllables. Each symbol/sound relationship was taught in isolation. On a test trial, they were given a series of 2 syllable words to read, written with 2 of the symbols they had been taught. Not surprisingly, they had no difficulty in reading these words, since they had been taught the code needed to read them.

Students in the whole word condition listened to me read the test words a few times, and then the students were ...ed to read the words. After each attempt, they were told what the correct word was. Not surprisingly, most students in this whole word

group made many errors with these unfamiliar words and symbols they had never encountered before.

In contrast, the students in the invariance condition were quickly able to read the words, even though they too had never seen the words or symbols before. With invariance training, students were able to extract symbol/sound correspondences, and in fact, they read the words as accurately as the students in the phonics condition, who had been taught the correspondences directly.

All students were then given a transfer task. They were asked to read words which included the previously used symbol/sound associations, but also introduced 2 new associations. We found, of course, that students learn exactly what you teach them.

For most students in the whole word group, this task was torture. Most used a global, whole word approach to the task. They tried to associate whole written words to whole spoken words, and were hopelessly confused.

Students in the phonics condition were more successful, since they knew at least some of the correspondences being used. Those students who were not successful had a clear explanation for their mistakes. They said "I can't read that symbol, you didn't teach that one to me. If you want me to read these words, you have to teach me what each letter says."

Students in the invariance condition had another view of the task. They thought it was fun, and they were confident. They

were correct to be confident; half of the students could read the all of the items, with the new correspondences, after a single practice trial. As a group, they had a nearly perfect score in reading the words.

These are preliminary data. They suggest a number of questions and conclusions. The first question is whether these results can be replicated with a larger group of normally achieving students. The second, and to me more important question, is whether learning disabled students will respond to this instruction.

If these questions are answered in the affirmative, then we can make three conclusions. First, active involvement by the student in discovering patterns can lead students to independently look for and find patterns. Second, the tendancy to search for patterns is a skill that can be taught or enhanced through direct instruction. Finally, I want to suggest that this skill could be an important one for students to acquire. Good readers know approximately 577 letter/sound associations, according to Gough and Hillinger. If we can do it, it would seem more efficient to teach students how to learn these patterns on their own than to provide phonics instruction for 577 letter/sound correspondences.

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Table 1

Pilot data from invariance study

Instruction	Number Correct on Training Trials (48 maximum)	Number Correct on Transfer Trials (36 maximum)
Whole Word	14	15
Phonics	45	23
Invariance	46	34